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(21) International Application Number: PCT/GB99/00644 (22) International Filing Date: 3 March 1999 (03.03.99) (30) Priority Data: ZA 98/1880 5 March 1998 (05.03.98) ZA (71) Applicant (for all designated States except US): LUNDIN INVESTMENTS (PROPRIETARY) LIMITED [ZA/ZA]; Sanclare Building, 5th floor, 21 Dreyer Street, Claremont, 7700 (ZA). (72) Inventors; and (75) Inventors/Applicants (for US only): KELLY, Elizabeth, Mary, Teresa [GB/GB]; 76A Lebanon Gardens, Wandsworth, London SW17 (GB). CLOHESSY, Justin, Peter [ZA/ZA]; 24 Bergendal Street, Constantia Hills, Cape Town, 7700 (ZA). (74) Agent: HALE, Stephen, Geoffrey; J.Y. & G.W. Johnson, Kingsbourne House, 229-231 High Holborn, London WC1V 7DP (GB).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: A COMPOSITION FOR MIXING OIL AND WATER TO FORM A SOLUTION (57) Abstract <p>A composition for mixing oil and water to form a solution includes a non-ionic ethoxylated sorbitan ester. The invention extends to a composition for mixing oil and water to form a solution which includes an oil-soluble grade of alcohol ethoxylate having a hydroxyl number greater than 160, a melting point below -15 °C, and a hydrophile-lipophile balance value less than 9, a diethanolamide of at least one higher fatty acid, and a polyethylene glycol ester of a higher fatty acid.</p>		

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A COMPOSITION FOR MIXING OIL AND WATER TO FORM A SOLUTION

THIS INVENTION relates to a composition for mixing oil and water to form a solution. It also relates to a solution of oil and water, and to a method of forming a solution of oil and water.

According to a first aspect of the invention, there is provided a composition for mixing oil and water to form a solution, the composition including a non-ionic ethoxylated sorbitan ester.

In this specification, the term "solution" is meant to include a mixture which is clear, homogenous and substantially stable.

The composition may include an oil-soluble grade of alcohol ethoxylate having a hydroxyl number greater than 160, a melting point below -15°C , and a hydrophile-lipophile balance value of less than 9.

The composition may also include a diethanolamide of at least one higher fatty acid.

The composition may further include a polyethylene glycol ester of a higher fatty acid and/or a polyethylene glycol ether of a higher fatty acid. Preferably, the composition includes a polyethylene glycol ester. An oleate is preferred to a laureate or a stearate.

According to a second aspect of the invention, there is provided a composition for mixing oil and water to form a solution, the composition including

an oil-soluble grade of alcohol ethoxylate having a hydroxyl number greater than 160, a melting point below -15°C , and a hydrophile-lipophile balance value of less than 9;

a diethanolamide of at least one higher fatty acid; and

a polyethylene glycol ester of a higher fatty acid.

The composition of the invention is particularly, though not necessarily exclusively suitable for mixing fuel oils and water to form a solution. Even more particularly, the composition is suitable for mixing diesel fuel oil and water to form a clear solution. The composition may thus be used as an additive to diesel fuel oil.

Unless otherwise indicated, all concentrations are given on a percentage by mass (mass%) basis.

The composition according to the second aspect of the invention may also include a non-ionic ethoxylated sorbitan ester.

The sorbitan ester may be present in the composition in a concentration of from 12% to 58% by mass. Preferably, the sorbitan ester is present in the composition in a concentration of from 24% to 46% by mass. Most preferably, the sorbitan ester is present in the composition in a concentration of from 29% to 41% by mass, e.g. 35% by mass. The sorbitan ester may have a hydrophile-lipophile balance value (HLB value) in the range of 16.4 - 16.7. An example of a suitable non-ionic ethoxylated sorbitan ester is Polysorbate 20 (Trademark), which is available in South Africa from Croda Chemicals (SA) (Pty) Limited of 4 Lovora Street, Jetpark.

The alcohol ethoxylate may be present in the composition in a concentration of from 7% to 29% by mass. Preferably, the alcohol ethoxylate is present in the composition in a concentration of from 12% to 22% by mass. Most

preferably, the alcohol ethoxylate is present in the composition in a concentration of from 15% to 20% by mass, e.g. 17,26% by mass. The alcohol ethoxylate may have an HLB value in the range of 7.7 - 8.3.

Preferably, the alcohol ethoxylate is in the form of a mixture of ethoxylates based on C₉ and C₁₁ alcohols. Even more preferably, the mixture of ethoxylates also includes ethoxylates of alcohols having chains of even numbers of carbon atoms. An example of a suitable alcohol ethoxylate mixture is Lutensol ON32 (Trademark), available in South Africa from BASF (Pty) Limited, 6 Carlisle Street, Paardeneiland, Cape Province.

The diethanolamide may be present in the composition in a concentration of from 20% to 61% by mass. Preferably, the diethanolamide is present in the composition in a concentration of from 30% to 51% by mass. Most preferably, the diethanolamide is present in the composition in a concentration of from 34% to 44% by mass, e.g. 40,49% by mass.

The higher fatty acids mentioned above with reference to the diethanolamides include conventional emulsifier-forming acids. Examples of particularly suitable diethanolamides are lauric diethanolamide and oleic diethanolamide. Typically, equal portions of lauric and oleic diethanolamide are present in the composition.

The polyethylene glycol ester preferably has a molecular weight of at least 400. The polyethylene glycol ester may have an HLB value in the range of 11.2 - 11.6.

The polyethylene glycol ester may be present in the composition in a concentration of from 4.9% to 6.5% by mass. Preferably, the polyethylene glycol ester is present in the composition in a concentration of from 5,4% to 6,3% by

mass. Most preferably, the polyethylene glycol ester is present in the composition in a concentration of from 5,6% to 6,0% by mass, e.g. 5,8% by mass.

The composition may include a surfactant when the sorbitan ester is not present or an additional surfactant to the sorbitan ester, when the sorbitan ester is present. Thus, the composition may include ethylene glycol monobutyl ether or ethylene glycol monoethyl ether. The ethylene glycol monobutyl ether or ethylene glycol monoethyl ether, as the case may be, may be present in the composition in a concentration of from 1.1% to 1.7% by mass. Preferably, the ethylene glycol monobutyl ether or ethylene glycol monoethyl ether, as the case may be, is present in the composition in a concentration of from 1,3% to 1,6% by mass, and most preferably in a concentration of from 1,4% to 1,5% by mass, e.g. 1,45% by mass.

The invention extends to a solution of an oil and water, which includes a composition as hereinbefore described.

The oil may be a fuel oil and the solution may include a fuel extender. The fuel extender may be an alcohol, such as ethanol. The fuel extender may be present in the solution in a concentration of up to about 5% by mass.

The invention further extends to a method of forming a solution of an oil and water, the method comprising adding and mixing a composition as hereinbefore described, oil and water together, the composition being added in an amount sufficient to provide a clear solution on mixing.

The minimum quantity of composition to be added to a water and oil mixture comprising a few (e.g. 2 - 5) volumetric parts water per 100 volumetric parts oil is typically between about 5 and 15 volumetric parts composition per 100 volumetric parts of water and oil mixture. The addition of too low a quantity of

composition to the oil and water is to be avoided as it may result in an emulsion being formed instead of a solution.

The volumetric ratio of the composition to the combined oil and water may be between 5:100 and 20:100 and the volumetric ratio of the water to the oil may be between 1:100 and 10:100. Preferably, the volumetric ratio of the composition to the combined oil and water is between 12,7:100 and 19,8:100 and the volumetric ratio of the water to the oil is between 1,7:100 and 8,6:100. Examples of the volumetric ratios of the composition, diesel oil and water are 15ml:116ml:2ml, 20ml:116ml:5ml, or 25ml:116ml:10ml.

The oil may be a fuel oil, particularly diesel fuel oil.

The invention will now be described with reference to the following non-limiting examples:

EXAMPLE 1

A composition comprising an alcohol ethoxylate (28.43%), lauric diethanolamide (20.24%), oleic diethanolamide (20.24%), polyethyleneglycol ester (4.93%), ethylene glycol monobutyl ether (1.16%) and Polysorbate 20 (25%) was prepared.

2ml of water were added to 100g of diesel fuel oil. Under stirring with a high speed stirrer, 15ml of the composition as prepared were added to the water and diesel oil. The result was a clear and stable solution showing no sign of breaking down after an extended period of time and at a temperature ranging between -3°C and +50°C. Thus, the oil and water mixture incorporating the composition of the invention formed a clear homogenous solution showing no signs of separation or instability.

EXAMPLE 2

5ml of water were added to 100g of diesel fuel oil. Under stirring with a high speed stirrer, 20ml of the composition as prepared for Example 1 were added to the water and diesel oil. The result was a clear and stable solution showing no sign of breaking down after an extended period of time and at a temperature ranging between -3°C and +50°C. Thus, the oil and water mixture incorporating the composition of the invention formed a clear homogenous solution showing no signs of separation or instability.

EXAMPLE 3

10ml of water were added to 100g of diesel fuel oil. Under stirring with a high speed stirrer, 25ml of the composition as prepared for Example 1 were added to the water and diesel oil. The result was a clear and stable solution showing no signs of breaking down after an extended period of time and at a temperature ranging between -3°C and +50°C. Thus, the oil and water mixture incorporating the composition of the invention formed a clear homogenous solution showing no signs of separation or instability.

EXAMPLE 4

Alcohol ethoxylate (17.26%), lauric diethanolamide (20.245%), oleic diethanolamide (20.245%), polyethylene glycol ester (5.8%), ethylene glycol monobutyl ether (1.45%) and Polysorbate 20 (35%) were added together to form a composition in accordance with the invention.

2ml of water were added to 100g of diesel fuel oil. Under stirring with a high speed stirrer, 10ml of the composition were added to the water and diesel oil. The result was a clear and stable solution showing no sign of breaking down after an extended period of time and at a temperature ranging between -3°C

and +50°C. Thus, the oil and water mixture incorporating the composition of the invention formed a clear homogenous solution showing no signs of separation or instability.

The Applicant expects that a fuel which includes the composition of the invention, as exemplified, will have an improved performance, will lead to a lower fuel consumption, and will have a cleaning effect on an engine. It is also an advantage of the composition, as exemplified, that it has a neutral effect on the octane and cetain ratings of diesel. The Applicant further expects a fuel which includes the composition of the invention, as exemplified, to have improved atomization properties, to burn more completely and cleanly and to have an improved flowability through pipelines.

It is an advantage of the composition of the invention, as exemplified, that it allows the formation of a stable solution of water and oil, which shows no sign of breaking down after extended periods of time.

CLAIMS

1. A composition for mixing oil and water to form a solution, the composition including a non-ionic ethoxylated sorbitan ester.

2. A composition as claimed in claim 1, in which the sorbitan ester is present in the composition in a concentration of from 12% to 58% by mass.

3. A composition as claimed in claim 2, in which the sorbitan ester is present in the composition in a concentration of from 29% to 41% by mass.

4. A composition as claimed in any one of the preceding claims, which includes an oil-soluble grade of alcohol ethoxylate having a hydroxyl number greater than 160, a melting point below -15°C, and a hydrophile-lipophile balance value of less than 9.

5. A composition as claimed in claim 4, in which the alcohol ethoxylate is present in the composition in a concentration of from 7% to 29% by mass.

6. A composition as claimed in claim 5, in which the alcohol ethoxylate is present in the composition in a concentration of from 15% to 20% by mass.

7. A composition as claimed in any one of claims 4 to 6 inclusive, in which the alcohol ethoxylate is in the form of a mixture of ethoxylates based on C₉ and C₁₁ alcohols.

8. A composition as claimed in claim 7, in which the mixture of ethoxylates also includes ethoxylates of alcohols having chains of even numbers of carbon atoms.

9. A composition as claimed in any one of the preceding claims, which includes a diethanolamide of at least one higher fatty acid.

10. A composition as claimed in claim 9, in which the diethanolamide is present in the composition in a concentration of from 20% to 61% by mass.

11. A composition as claimed in claim 10, in which the diethanolamide is present in the composition in a concentration of from 34% to 44% by mass.

12. A composition as claimed in any one of the preceding claims, which includes a polyethylene glycol ester of a higher fatty acid.

13. A composition as claimed in claim 12, in which the polyethylene glycol ester has a molecular weight of at least 400.

14. A composition as claimed in claim 13, in which the polyethylene glycol ester is present in the composition in a concentration of from 4.9% to 6.5% by mass.

15. A composition as claimed in any one of the preceding claims, which includes ethylene glycol monobutyl ether or ethylene glycol monoethyl ether.

16. A composition as claimed in claim 15, in which the ethylene glycol monobutyl ether or ethylene glycol monoethyl ether, as the case may be, is present in the composition in a concentration of from 1.1% to 1.7% by mass.

17. A composition for mixing oil and water to form a solution, the composition including

an oil-soluble grade of alcohol ethoxylate having a hydroxyl number greater than 160, a melting point below -15°C , and a hydrophile-lipophile balance value less than 9;

a diethanolamide of at least one higher fatty acid; and

a polyethylene glycol ester of a higher fatty acid.

18. A composition as claimed in claim 17, which includes a non-ionic ethoxylated sorbitan ester.

19. A composition as claimed in claim 18, in which the sorbitan ester is present
5 in the composition in a concentration of from 12% to 58% by mass.

20. A composition as claimed in claim 19, in which the sorbitan ester is present in the composition in a concentration of from 29% to 41% by mass.

21. A composition as claimed in any one of claims 17 to 20 inclusive, in which the alcohol ethoxylate is present in the composition in a concentration of from 7%
10 to 29% by mass.

22. A composition as claimed in claim 21, in which the alcohol ethoxylate is present in the composition in a concentration of from 15% to 20% by mass.

23. A composition as claimed in any one of claims 17 to 22 inclusive, in which the alcohol ethoxylate is in the form of a mixture of ethoxylates based on C₈ and
5 C₁₁ alcohols.

24. A composition as claimed in claim 23, in which the mixture of ethoxylates also includes ethoxylates of alcohols having chains of even numbers of carbon atoms.

25. A composition as claimed in any one of claims 17 to 24 inclusive, in which
10 the diethanolamide is present in the composition in a concentration of from 20% to 61% by mass.

26. A composition as claimed in claim 25, in which the diethanolamide is present in the composition in a concentration of from 34% to 44% by mass.

27. A composition as claimed in any one of claims 17 to 26 inclusive, in which the polyethylene glycol ester has a molecular weight of at least 400.

28. A composition as claimed in claim 27, in which the polyethylene glycol ester is present in the composition in a concentration of from 4.9% to 6.5% by mass.

29. A composition as claimed in any one of claims 17 to 28 inclusive, which includes ethylene glycol monobutyl ether or ethylene glycol monoethyl ether.

30. A composition as claimed in claim 29, in which the ethylene glycol monobutyl ether or ethylene glycol monoethyl ether, as the case may be, is present in the composition in a concentration of from 1.1% to 1.7% by mass.

31. A solution of oil and water, which includes a composition as claimed in any one of the preceding claims.

32. A solution as claimed in claim 31, in which the oil is a fuel oil and which includes a fuel extender.

33. A solution as claimed in claim 32, in which the fuel extender is an alcohol.

34. A method of forming a solution of oil and water, the method including adding and mixing a composition as claimed in any one of claims 1 to 30 inclusive, oil and water together, the composition being added in an amount sufficient to provide a clear solution on mixing.

35. A method as claimed in claim 34, in which the volumetric ratio of the composition to the combined oil and water is between 5:100 and 20:100 and the volumetric ratio of the water to the oil is between 1:100 and 10:100.

36. A method as claimed in claim 35, in which the volumetric ratio of the composition to the combined oil and water is between 12,7:100 and 19,8:100 and the volumetric ratio of the water to the oil is between 1,7:100 and 8,6:100.

37. A method as claimed in any one of claims 34 to 36 inclusive, in which the oil is a fuel oil.

38. A composition as claimed in claim 1 or claim 17, substantially as herein described.

39. A solution as claimed in claim 31, substantially as herein described.

40. A method of forming a solution of oil and water as claimed in claim 34, substantially as herein described.

41. A new composition, a new solution, or a new method of forming a solution, substantially as herein described and illustrated.

INTERNATIONAL SEARCH REPORT

Int ernational Application No

PCT/GB 99/00644

A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 560 482 A (G.P.CANEVARI) 24 December 1985 see claims 1-5	1-3
X	WO 95 09900 A (ICI) 13 April 1995 see claims 1-13	1
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

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(54) Title: A COMPOSITION FOR MIXING OIL AND WATER TO FORM A SOLUTION		
(57) Abstract A composition for mixing oil and water to form a solution includes a non-ionic ethoxylated sorbitan ester. The invention extends to a composition for mixing oil and water to form a solution which includes an oil-soluble grade of alcohol ethoxylate having a hydroxyl number greater than 160, a melting point below -15 °C, and a hydrophile-lipophile balance value less than 9, a diethanolamide of at least one higher fatty acid, and a polyethylene glycol ester of a higher fatty acid.		

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AMENDED CLAIMS

[received by the International Bureau on 25 August 1999 (25.08.99);
original claims 1-41 replaced by amended claims 1-40 (6 pages)]

1. A composition for mixing oil and water to form a solution, the composition including
a non-ionic ethoxylated sorbitan ester; and
5 an oil-soluble grade of alcohol ethoxylate having a hydroxyl number greater than 160, a melting point below -15°C , and a hydrophile-lipophile balance value of less than 9.
2. A composition as claimed in claim 1, in which the sorbitan ester is present in the composition in a concentration of from
10 12% to 58% by mass.
3. A composition as claimed in claim 2, in which the sorbitan ester is present in the composition in a concentration of from 29% to 41% by mass.
4. A composition as claimed in any one of claims 1 to 3
15 inclusive, in which the alcohol ethoxylate is present in the composition in a concentration of from 7% to 29% by mass.
5. A composition as claimed in claim 4, in which the alcohol ethoxylate is present in the composition in a concentration of from 15% to 20% by mass.
- 20 6. A composition as claimed in any one of claims 1 to 5 inclusive, in which the alcohol ethoxylate is in the form of a mixture of

ethoxylates based on C₉ and C₁₁ alcohols.

7. A composition as claimed in claim 6, in which the mixture of ethoxylates also includes ethoxylates of alcohols having chains of even numbers of carbon atoms.
- 5 8. A composition as claimed in any one of the preceding claims, which includes a diethanolamide of at least one higher fatty acid.
9. A composition as claimed in claim 8, in which the diethanolamide is present in the composition in a concentration of
10 from 20% to 61% by mass.
10. A composition as claimed in claim 9, in which the diethanolamide is present in the composition in a concentration of from 34% to 44% by mass.
11. A composition as claimed in any one of the preceding
15 claims, which includes a polyethylene glycol ester of a higher fatty acid.
12. A composition as claimed in claim 11, in which the polyethylene glycol ester has a molecular weight of at least 400.
13. A composition as claimed in claim 12, in which the
20 polyethylene glycol ester is present in the composition in a concentration of from 4.9% to 6.5% by mass.

14. A composition as claimed in any one of the preceding claims, which includes ethylene glycol monobutyl ether or ethylene glycol monoethyl ether.
- 5 15. A composition as claimed in claim 14, in which the ethylene glycol monobutyl ether or ethylene glycol monoethyl ether, as the case may be, is present in the composition in a concentration of from 1.1% to 1.7% by mass.
- 10 16. A composition for mixing oil and water to form a solution, the composition including
an oil-soluble grade of alcohol ethoxylate having a hydroxyl number greater than 160, a melting point below -15°C , and a hydrophile-lipophile balance value less than 9;
a diethanolamide of at least one higher fatty acid; and
a polyethylene glycol ester of a higher fatty acid.
- 15 17. A composition as claimed in claim 16, which includes a non-ionic ethoxylated sorbitan ester.
18. A composition as claimed in claim 17, in which the sorbitan ester is present in the composition in a concentration of from 12% to 58% by mass.
- 20 19. A composition as claimed in claim 18, in which the sorbitan ester is present in the composition in a concentration of from 29% to 41% by mass.

20. A composition as claimed in any one of claims 16 to 19 inclusive, in which the alcohol ethoxylate is present in the composition in a concentration of from 7% to 29% by mass.

5 21. A composition as claimed in claim 20, in which the alcohol ethoxylate is present in the composition in a concentration of from 15% to 20% by mass.

22. A composition as claimed in any one of claims 16 to 21 inclusive, in which the alcohol ethoxylate is in the form of a mixture of ethoxylates based on C₉ and C₁₁ alcohols.

10 23. A composition as claimed in claim 22, in which the mixture of ethoxylates also includes ethoxylates of alcohols having chains of even numbers of carbon atoms.

24. A composition as claimed in any one of claims 16 to 23 inclusive, in which the diethanolamide is present in the composition in
15 a concentration of from 20% to 61% by mass.

25. A composition as claimed in claim 24, in which the diethanolamide is present in the composition in a concentration of from 34% to 44% by mass.

20 26. A composition as claimed in any one of claims 16 to 25 inclusive, in which the polyethylene glycol ester has a molecular weight of at least 400.

27. A composition as claimed in claim 26, in which the polyethylene glycol ester is present in the composition in a concentration of from 4.9% to 6.5% by mass.
28. A composition as claimed in any one of claims 16 to 27 inclusive, which includes ethylene glycol monobutyl ether or ethylene glycol monoethyl ether.
29. A composition as claimed in claim 28, in which the ethylene glycol monobutyl ether or ethylene glycol monoethyl ether, as the case may be, is present in the composition in a concentration of from 1.1% to 1.7% by mass.
30. A solution of oil and water, which includes a composition as claimed in any one of the preceding claims.
31. A solution as claimed in claim 30, in which the oil is a fuel oil and which includes a fuel extender.
32. A solution as claimed in claim 31, in which the fuel extender is an alcohol.
33. A method of forming a solution of oil and water, the method including adding and mixing a composition as claimed in any one of claims 1 to 29 inclusive, oil and water together, the composition being added in an amount sufficient to provide a clear solution on mixing.

34. A method as claimed in claim 33, in which the volumetric ratio of the composition to the combined oil and water is between 5:100 and 20:100 and the volumetric ratio of the water to the oil is between 1:100 and 10:100.
- 5 35. A method as claimed in claim 34, in which the volumetric ratio of the composition to the combined oil and water is between 12,7:100 and 19,8:100 and the volumetric ratio of the water to the oil is between 1,7:100 and 8,6:100.
- 10 36. A method as claimed in any one of claims 33 to 35 inclusive, in which the oil is a fuel oil.
37. A composition as claimed in claim 1 or claim 16, substantially as herein described.
38. A solution as claimed in claim 30, substantially as herein described.
- 15 39. A method of forming a solution of oil and water as claimed in claim 33, substantially as herein described.
40. A new composition, a new solution, or a new method of forming a solution, substantially as herein described and illustrated.

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